



AVM Task 3: Standards Development and Promulgation

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VIMANA | by System
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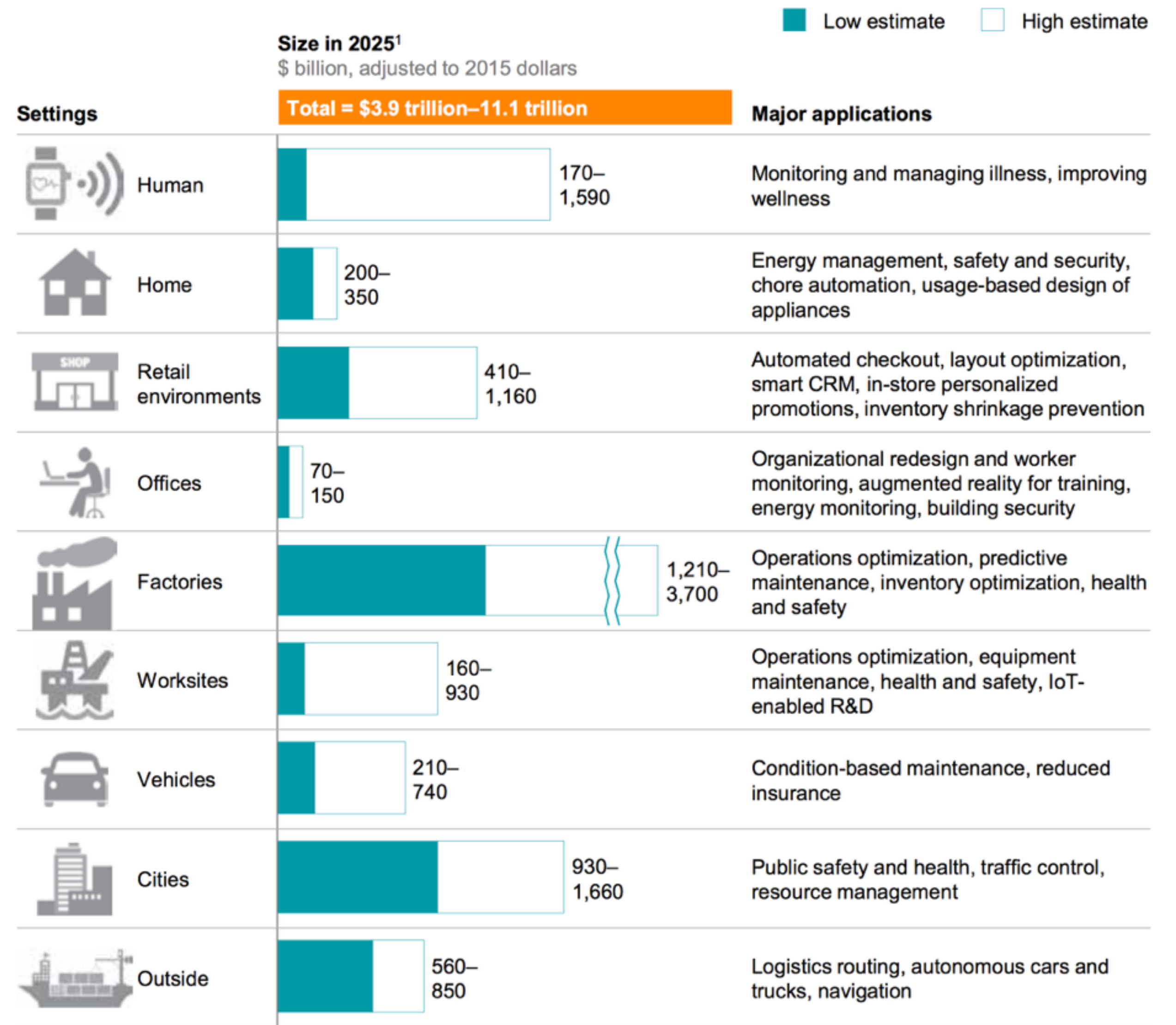
Background

Internet of Things

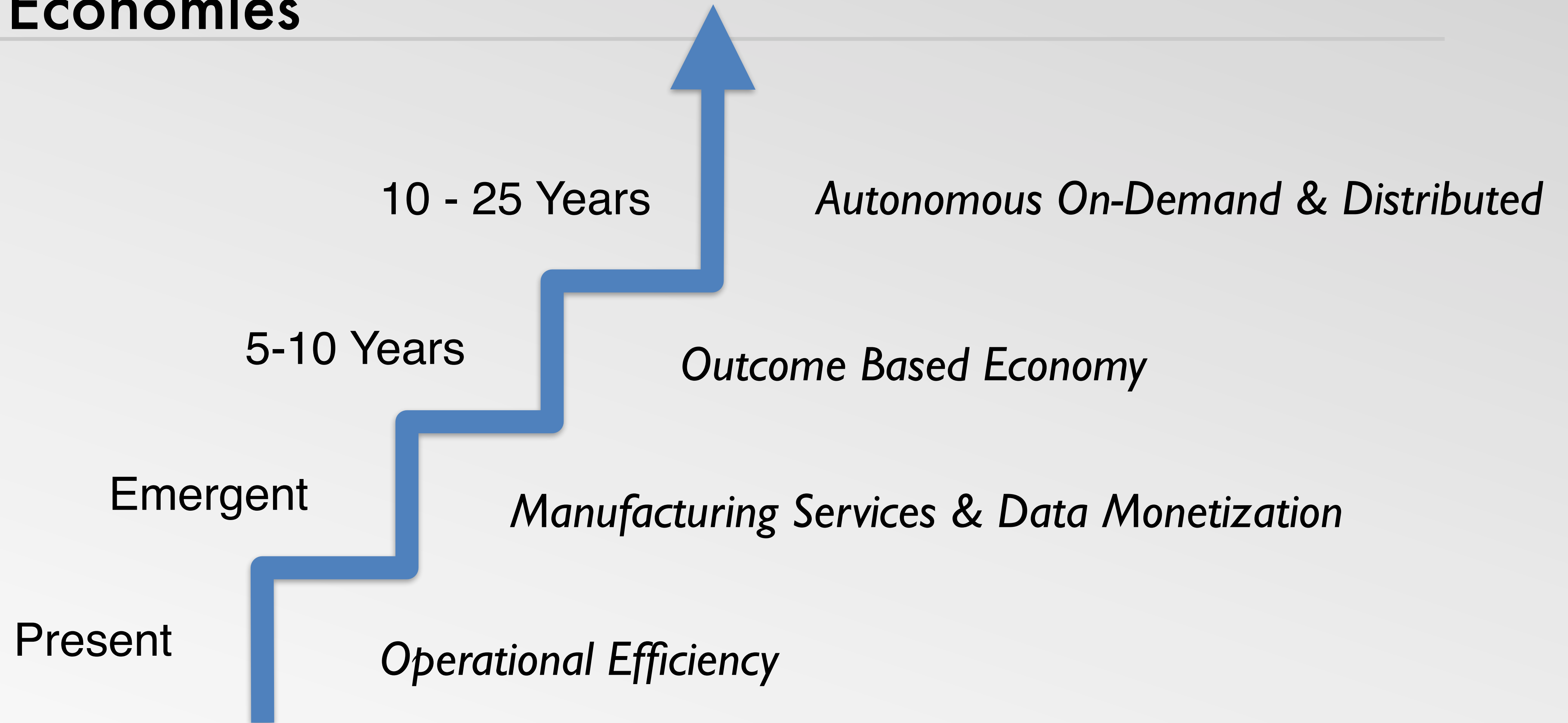
- Industrial vs. Everything Else
 - Highest potential Impact
 - \$1.2 - 3.7T
- Areas
 - Operations Optimization
 - Predictive Maintenance
 - Inventory Optimization
 - Health and Safety

McKinsey Global Institute
 THE INTERNET OF THINGS: MAPPING THE VALUE
 BEYOND THE HYPE
 JUNE 2015

Potential economic impact of IoT in 2025, including consumer surplus, is \$3.9 trillion to \$11.1 trillion

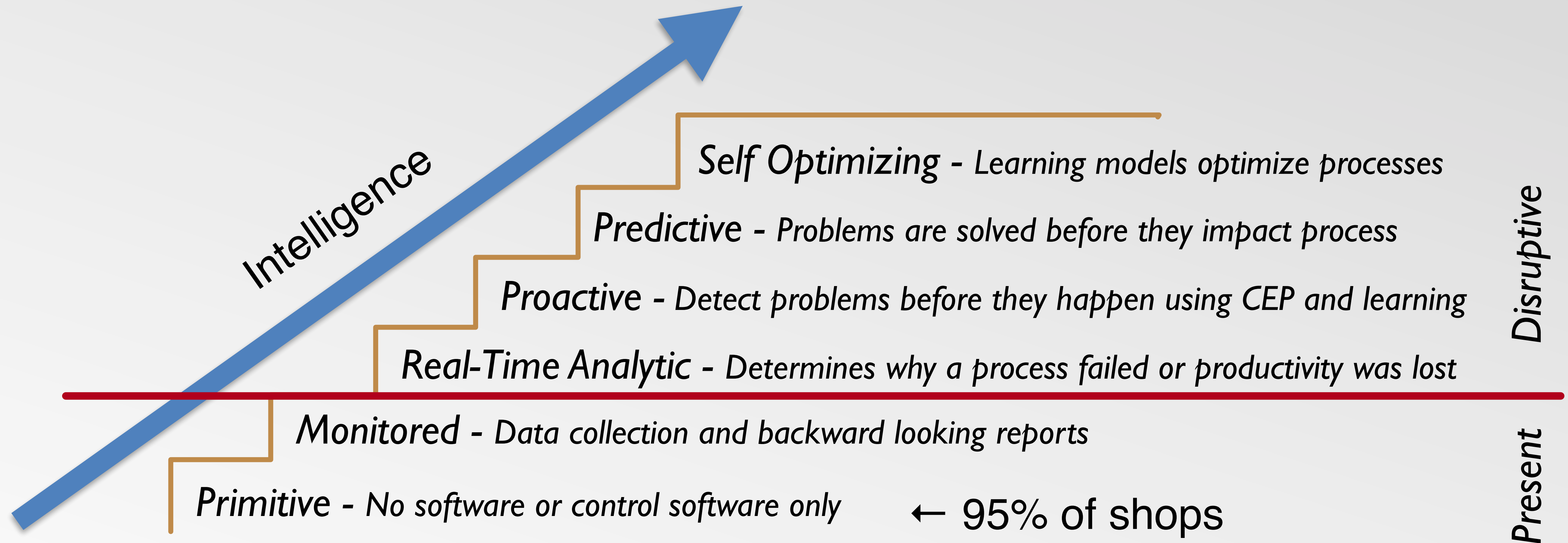


New Economies

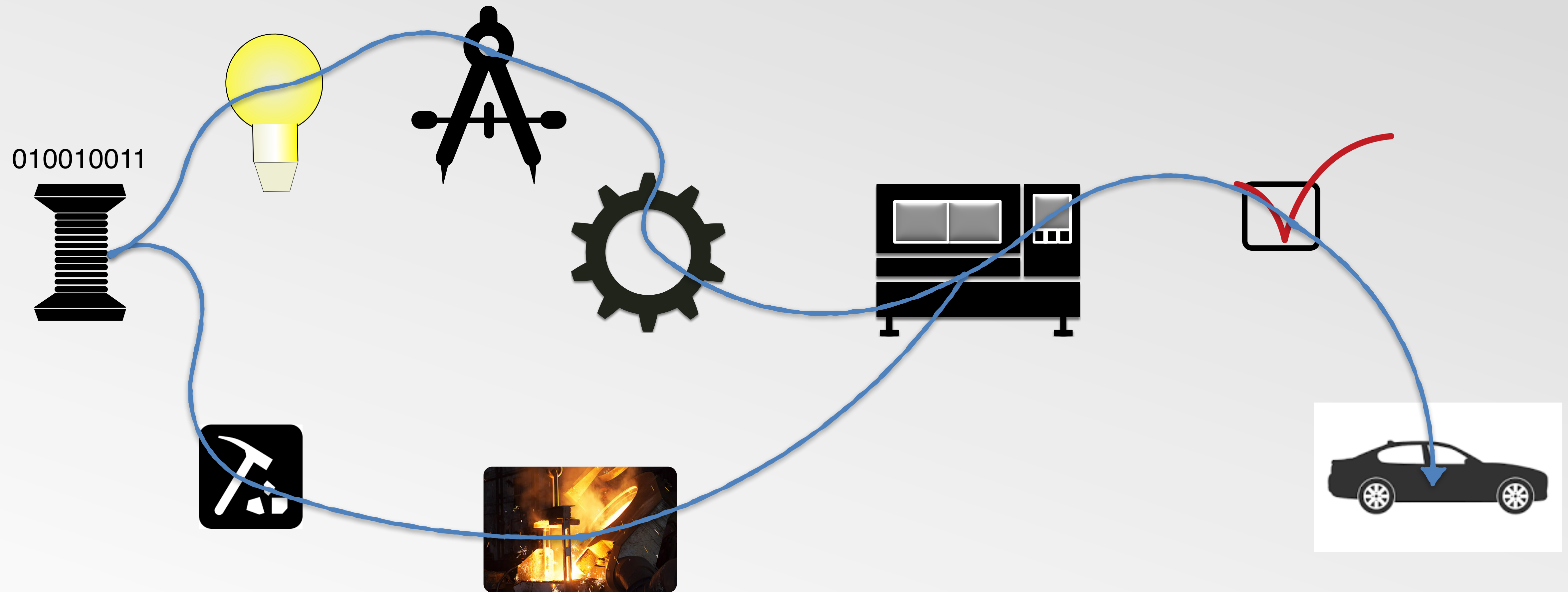


*World Economic Forum: Industrial Internet of Things:
Unleashing the Potential of Connected Products and Services, Jan 2011*

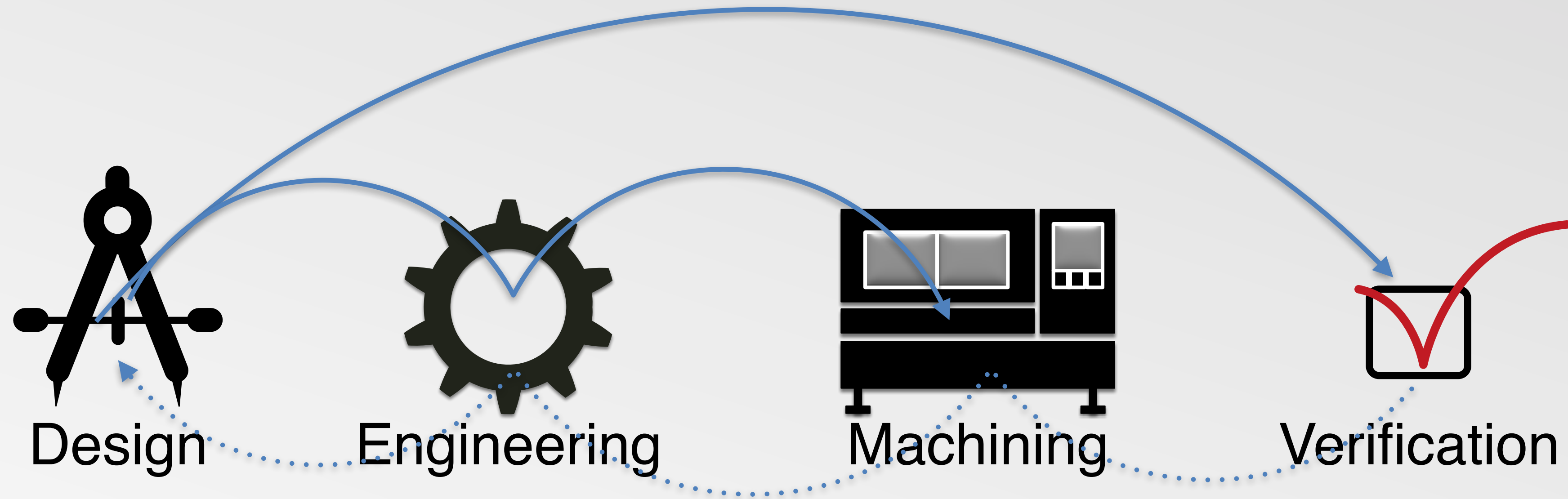
Intelligence Hierarchy



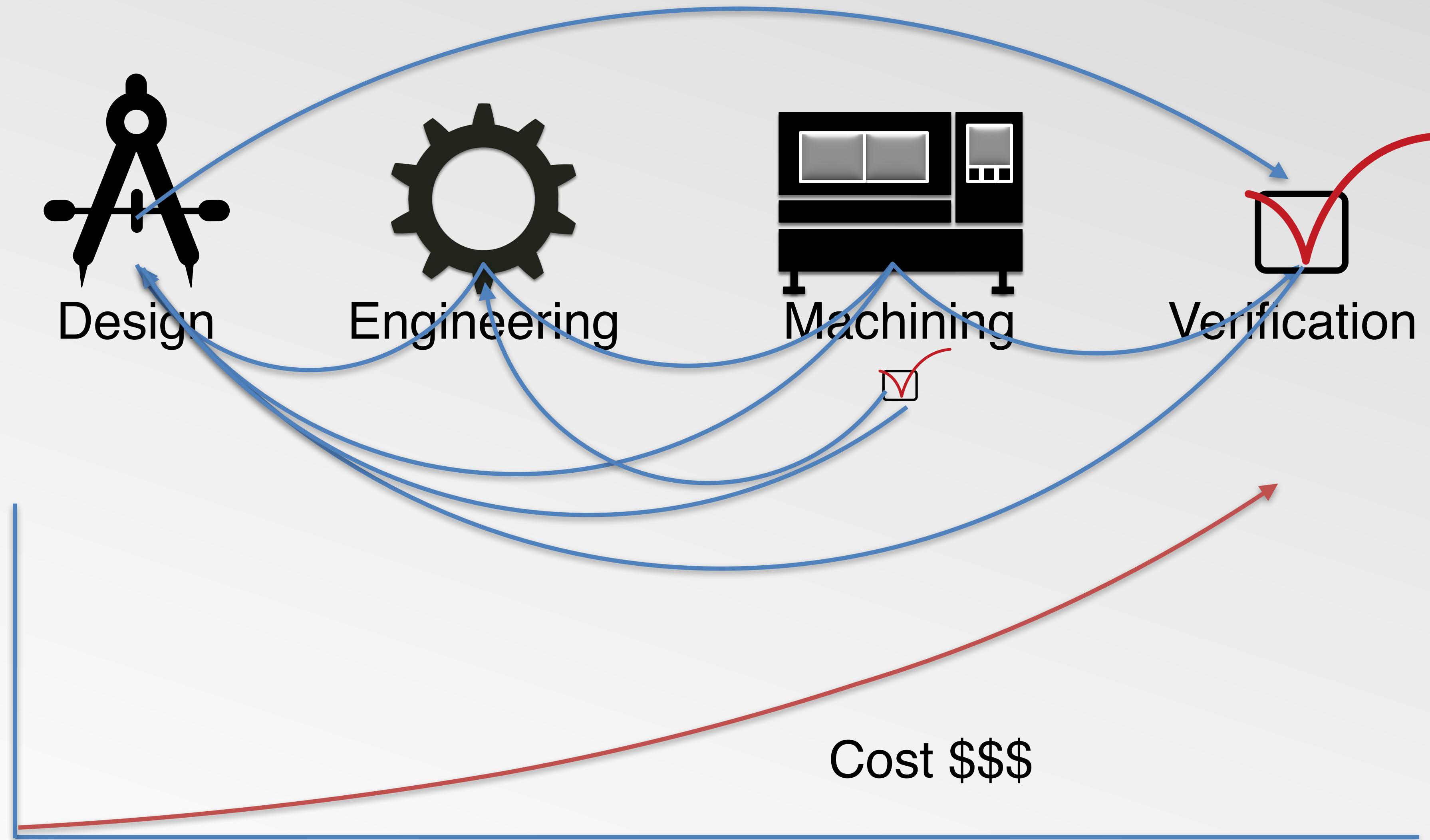
Digital Thread



Current Feedback



Digital Manufacturing Feedback

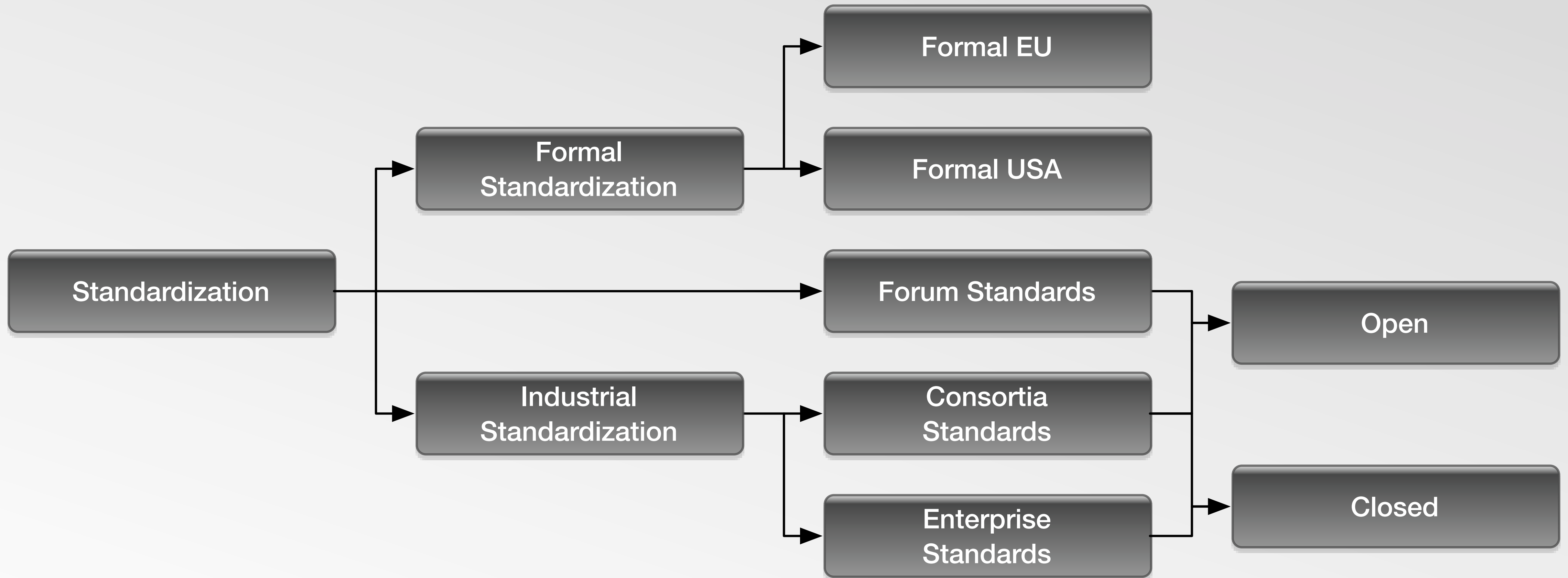


What is the value MBE?

Total output = 70T – 10% improvement from design efficiency?
30%?

Standards

Types of Standards



Types of Standards

Process	ISO-9000	ISO-27001	ISO-50001	CMMI
Semantic Models	ISA-95	STEP (AP-2XX)	QIF	MTConnect
Transport Syntax	OPC/UA	MQTT	AMQP	
Communication	TCP/IP	UDP	RS-422	XBee
Security	DES	SSL	TLS	KERBEROS

Requirements for Open Standards

1. Open Meeting
2. Consensus
3. Due Process
4. Open World
5. Open IPR
6. Open Change
7. Open Documents
8. Open Interface
9. Open Use
10. On-Going Support

Open Standards Requirements:

Ken Krechmer, Internation Center for Standards Research, USA [2008]

Network Effects

- Analytical simulation based model on standard concentration and adoption within supply chain

Table 1. Determinants and parameters simulating diffusion dynamics in supply networks

ID	Determinants	Parameters	Description
1	Communication intensity	Size of enterprise q_i	Size of an organization (define size distribution for each type)
2		Number of sourcing relationships g_i	Sourced parts of agent i from different tier
3	Costs	Implementation costs $K(q_i)$	Costs to implement a standard
4		Maximum communication costs $C(q_i)$	Maximum savings per relationship
5	Communication partner influence	Communication cost savings $C(q_i, q_j)$	Reduction of communication costs for partners implementing the same standards
6	Personal network exposure	Relationship stability between tiers p_c^{main}	Probability of transaction with main supplier
7		Number of suppliers n_c	Number of potential suppliers per sourced part
8	Opinion leadership (power)	Economic base power b_i^{eco}	Power sources other than size-based technological and economic power
9		Technological knowledge b_i^{tech}	Network participant's technological knowledge
10	Opinion leadership (location)	Set of agents in tier $O_c \subset Agents$	Position (tier c) within the supply network
11	Intragroup pressure toward conformity	Market pressure functions	Pressure that partner agents can exert on the deciding agent to implement their standard

A Diffusion Model for Communication Standards in Supply Networks,
M. Schwind, T. Stockheim, K. Weiss

Results

- High relationship stability (inflexible supply chain) leads to a decrease of std concentration
 - Supply chain connectivity strongly influences the outcome in two ways
 - Higher tendency toward the standards' concentration since an increased connectivity reduces the probability of subnetworks
 - Shift of market pressure along the supply chains, leading to changed relevance of the tier organizations
 - Market power and network topology strongly influence the propagation of standards along the supply chains
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- Low relationship stability
 - Highly connected supply chains
 - Low centrality of supply structures
 - Homogeneous market power

Open Standards Requirements:
*Ken Krechmer, Internation Center for Standards
Research, USA [2008]*

Example 1: Document Formats

- Microsoft Word is dominate interchange format for documents
- Issues:
 - Controlled by one company
 - Enterprise Standard
 - Is not Open
- Print Formats - PDF ISO 36000-1
- OpenDocument Format 26300 (OASIS)
 - Still in development and becoming the standard for document interchange for non-Microsoft players
 - NATO has standardized on OpenDocument
 - Google is pushing to dislodge Microsoft
- The issue: docx → ODF → docx or docx → ODF → X → PDF

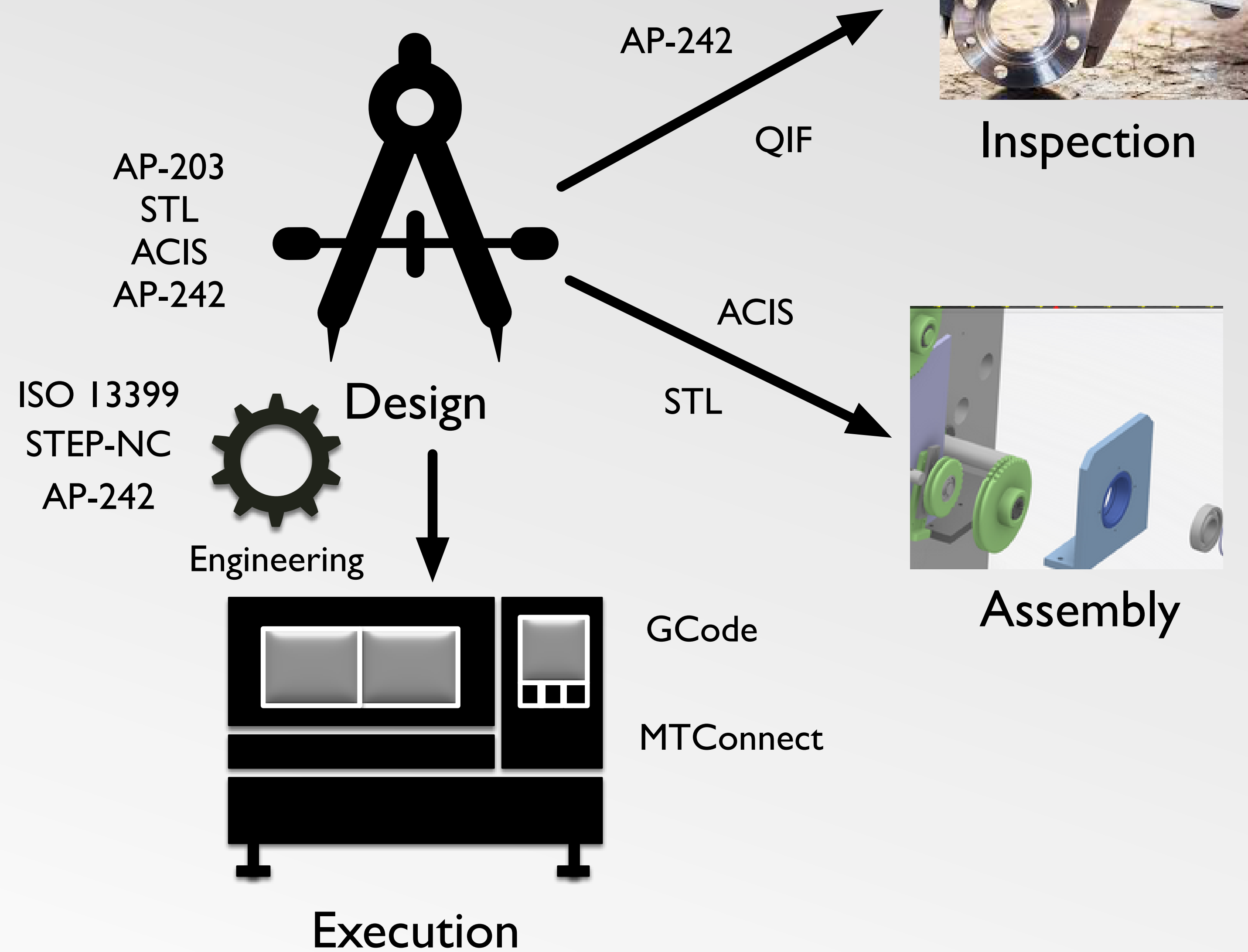
Example 2: GNU/Linux vs. Microsoft

- Back in '90s Microsoft dominant in market. There were a few options: Microsoft on desktop, Solaris, HPUNIX, Digital VMS/OS10, and IBM AIX. Solaris, HPUNIX, and AIX are all POSIX based (standardized, but porting is still difficult).
- Companies *standardized* on proprietary technologies
- Cost of development environments – compilers and technology was prohibitive
- In 80's we believed that only *large* companies could develop something as complex as an operating system
- Linux disrupted all proprietary server side software
- Cost of development went to ~\$0. Hosting went to ~\$0
- Services emerged and technology expanded exponentially
- R vs. S-Plus & SAS.

What was needed?

- GNU Posix tools, compiler, and technology
- LINUX Kernel
- 100's of 1000's of programmers
- Control of the blessed product
- New business models (RedHat, etc...)

- Why open source?
 - For a small company, how can we get 1000's of programmers working on a product?
 - Where do you make your money?
- University involvement – research (Hadoop & R)



Market First

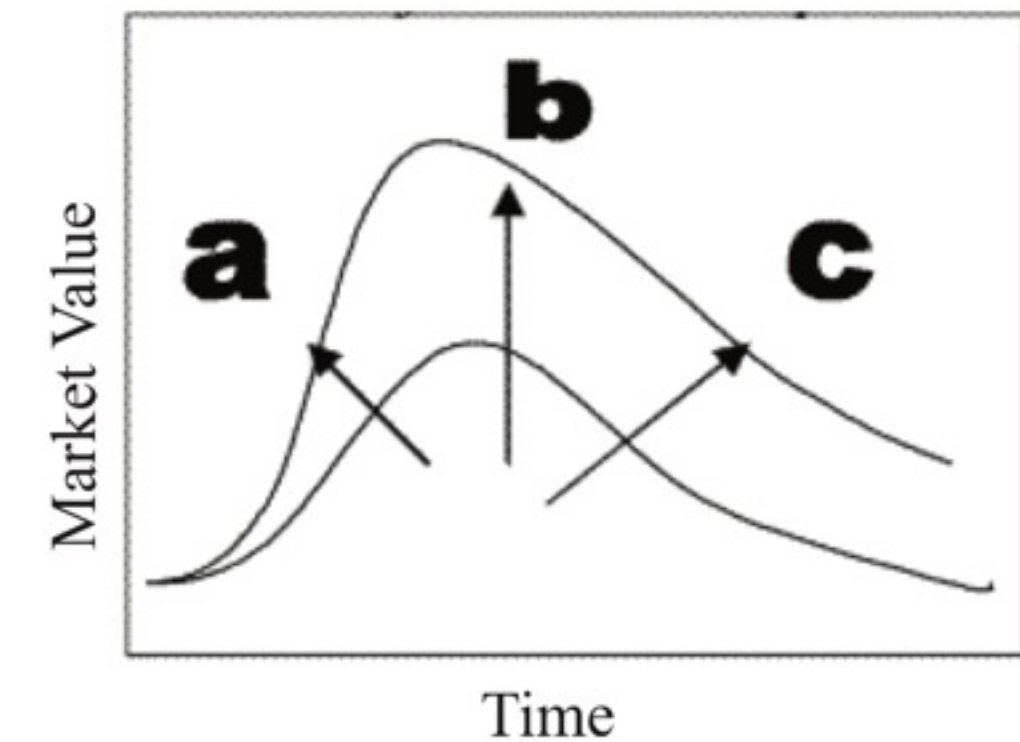
Build it and they will come....

And if they don't....

Market Impact

- A: Initial market increases faster
- B: Size of market is greater
- C: Longer tail and durability

Figure 1. Potential for standards impact on market curve

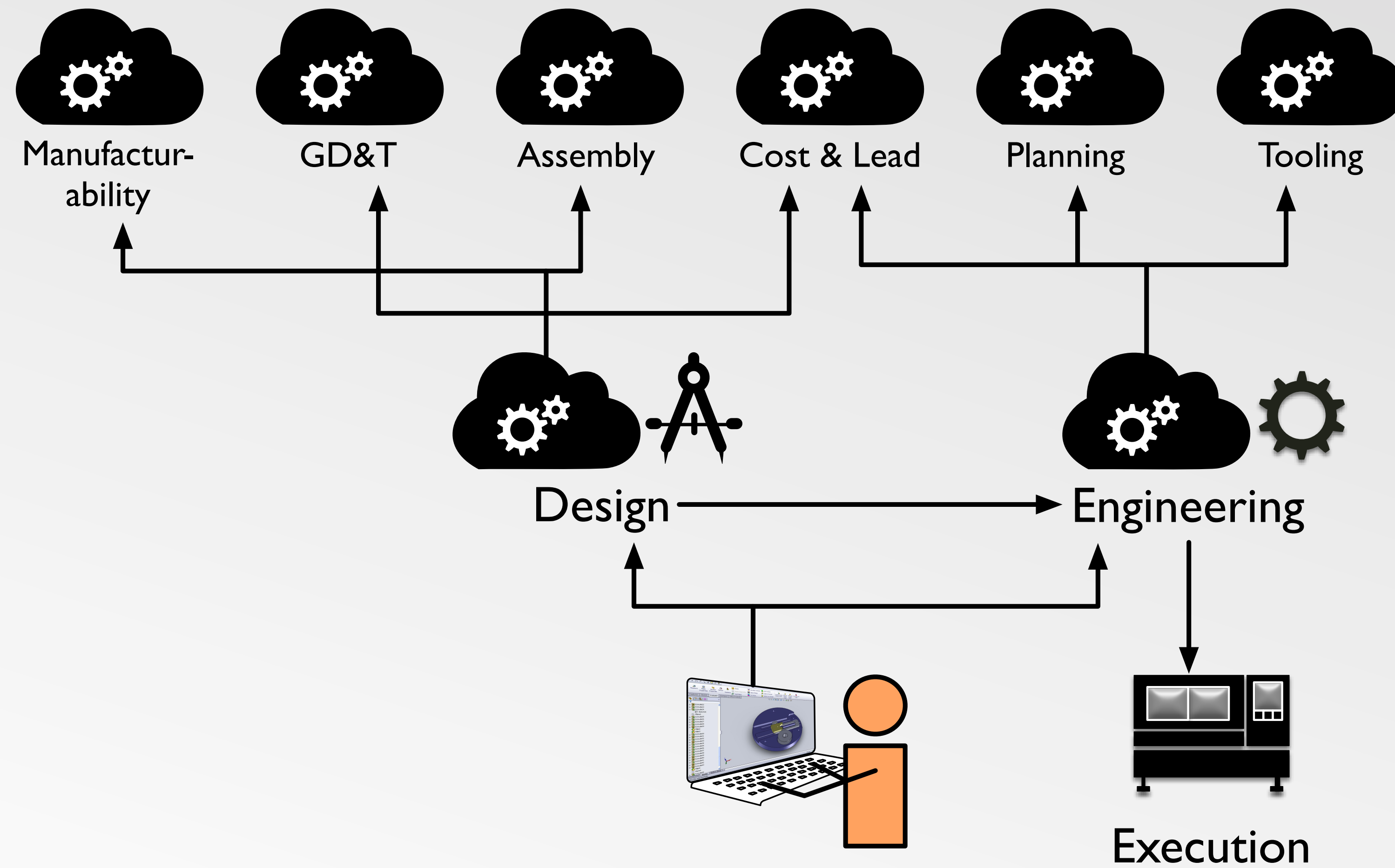


IT Standardization: The Billion Dollar Strategy,
John Hurd & Jim Isaak, 2008 IGI Global

Aligning with Market Need

- What are the top drivers that will drive the adoption?
 - Impediments and Drivers
 - Documents → Collaboration
 - New Economies
-
- What are the largest opportunities in the industry?
-
- In the US?
-
- Globally?

Services

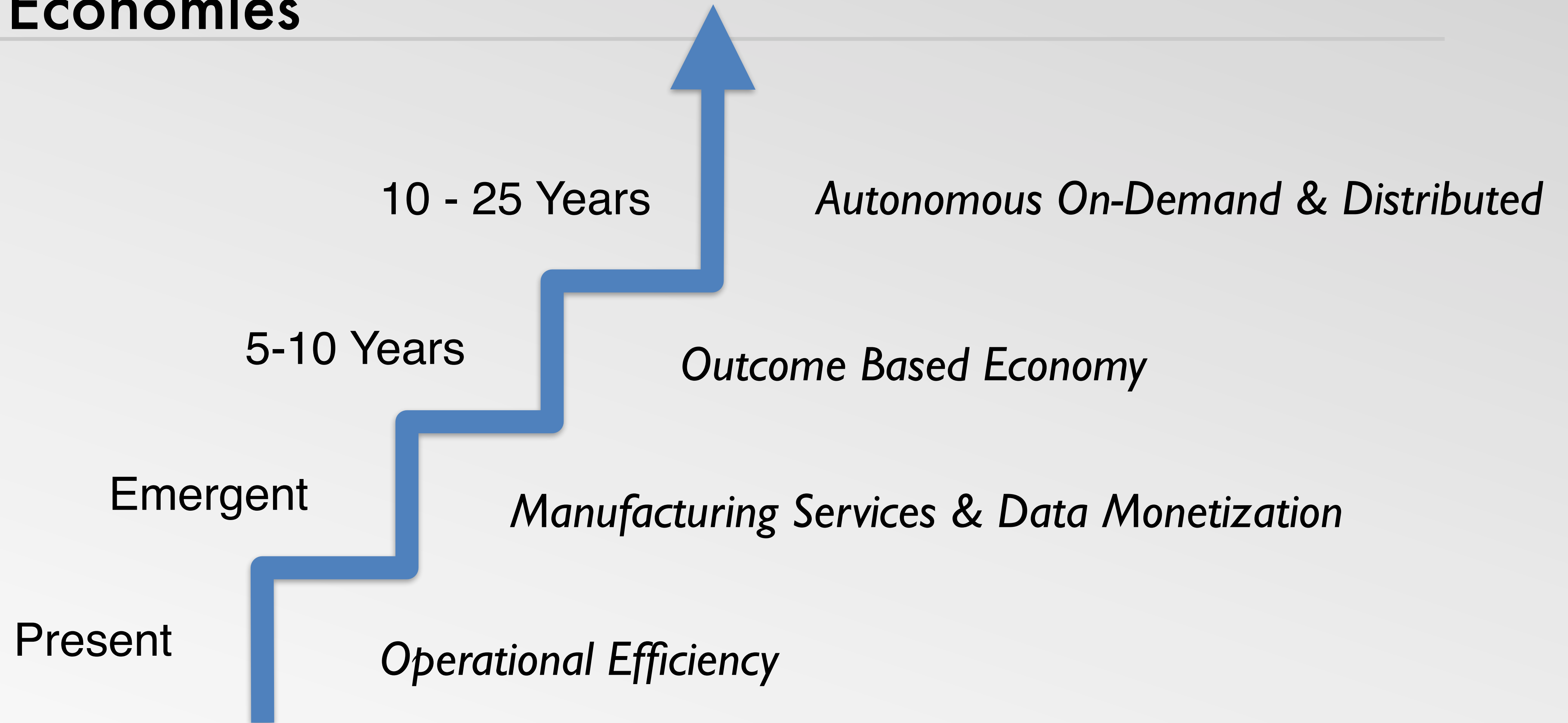


Standards are Contracts

- Open Contracts are key to connecting services
- Allows *low (read ~\$0) cost* integration
- Democratizes Innovation



New Economies



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Questions?